Tensile Tester for In-Sito Scanning Electron Microscopy
By Team G7 Designs

Team Members
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Project Description
Creation of Tensile Tester for applications within materials research. Tensile Tester is to be placed within scanning electron microscopy (SEM) to observe fracture and deformation of aluminum and magnesium specimens. To be used for SDSU research by Dr. Wenwu Xu and graduate students.

The SEM
Our Tensile Tester must fit within the testing chamber of the SEM in order to view the specimens as they are being fractured. Due to the weight of the components of the Tensile Tester, the Tester will not be able to be moved around on the stage once inside the chamber. Therefore, specimen placement on the Tester itself is critical. While most samples being viewed in the SEM can be adjusted for view under the electron beam, our sample must be perfectly placed so that the electron beam is directly on top of the specimen. The cooling arm on the right of the SEM must also be removed and replaced with a pass through in order to provide power to the motor and load cell.

Electrical Components
There are three main electrical components for this tensile tester as shown in the pictures. In order to connect the hardware inside the vacuum chamber to the outside of the SEM, an SEM passthrough with two 9 pin male D-sub connectors was designed. A female D-sub adapter was used to connect the necessary pins from the load cell, the motor power connector and the motor communication cable.

Testing
Phase 1
- Test all Electronics individually to ensure all code works as expected.
- Calibrate and test Load Cell.
- Calculate stepper motor rotational to linear conversion.
Phase 2
- Assemble tensile tester and integrate all electronics.
- Begin testing using 3D printed samples and “Thin” aluminum samples.
- Ensure all components align and sample breaks as intended.
- Test with at least one “Regular” aluminum sample.
- Evaluate if any adjustments need to be made to design/parts need to be re manufactured.
Phase 3
- Make any adjustments to parts/design if needed.
- Test inside SEM.

Final Design
In the image above the final assembled model can be seen. There is a communication cable and power source connected to the motor, with a load cell at the end of the carriage to measure tension force.

By using the SureMotion Pro software, we are able to feed commands to the motor to generate a linear carriage motion. The speed and linear distance can be calculated and changed accordingly depending on the research application.